A Retrospective Evaluation of Hydrocellulose Dressings in the Management of Chronic Wounds

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The amount of wound exudate is an important consideration in the process of selecting dressings and a dressing that can handle varying amounts of exudate has the potential to play an important role in healing. A retrospective single-center study was conducted in patients with chronic wounds to evaluate the effects of a cellulose dressing indicated for both dry and moist wounds. Participants included 54 patients with 96 ulcers (27 diabetic foot, 41 venous, 21 ischemic ulcers, and seven ulcers of other etiologies. All wounds were managed using standard moist wound care followed by care using the cellulose dressing. Change in wound area and patient pain following use of the standard and cellulose dressing were compared. The difference in median percent reduction following use of the two dressing regimens was significantly different (−35% [-100 to 92,492] versus 0.0 [-99.82 to 5,597], P = 0.006). Pain had been reduced in 33% of patients following standard care; after cellulose dressing treatment, an additional 28% reported less pain. No skin irritation or allergies developed. The cellulose dressing was found to be safe and effective in this patient population with difficult-to-heal ulcers.

KEYWORDS: exudate management, hydrocellulose dressing, hard-to-heal wounds

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Healing chronic wounds is a multifactorial process. Treatment of the underlying disease and extrinsic factors such as patient adherence to regimens and concomitant medication must be addressed, along with several wound-based parameters, such as infection, bone involvement, or ischemia that will interfere with healing. Thus, comprehensive wound care protocols are indicated in the management of nonhealing wounds. One major goal of these protocols is to improve the wound environment in order to create a moist wound that facilitates granulating tissue formation and reduces pain and odor. Modern wound dressings that have optimal exudate management properties have the potential to achieve this goal.

Dressing selection should consider that the amount of exudate varies in each individual wound. Foam dressings are indicated for moderately exuding wounds and films or hydrogels moisten dry minimally exuding wounds. Additionally, exudation often...
changes during the course of healing. Exudate production may increase after wound debridement and decrease when epithelialization begins. This implies a potentially important role for dressings capable of managing both dry and highly exudative ulcers.\(^{18,19}\)

Pain relief is another important aspect of wound care, not only because of its impact on quality of life\(^{20-21}\) but also because of the negative influence of pain on healing. Pain has been shown to lead to vasoconstriction with subsequent decrease of tissue oxygen tension, impairing healing.\(^{22}\) Consequently, the importance of pain relief is growing, underscored by the recent introduction of a dressing that releases ibuprofen. A small single-center crossover study\(^{23}\) indicated that an ibuprofen-releasing dressing is capable of reducing persistent and temporary wound pain regarding this dressing, but the efficacy of reducing pain using a dressing is debatable because pain relief may be more effective and better controlled by oral analgesics.\(^{24}\) In addition, an optimal and moist wound environment might reduce pain without use of pain medication.

XCell\(^{®}\), available under the name Suprasorb X\(^{®}\), sold by Lohmann Rauscher\(^{®}\) (Rengsdorf, Germany) and Xylos\(^{®}\) Corporation (Langhorne, Pa), is a cellulose dressing indicated for the management of moderately exudating and dry wounds. (see Figure 1). The purpose of this single-center retrospective study was to evaluate healing outcomes using standard care compared to outcomes using the cellulose dressing.

**Methods**

A single-center, retrospective analysis was conducted using a database of patients treated first with standard care and then with the cellulose dressing. Between 2003 and 2005, a total of 603 patients with 1,419 wounds were treated at the outpatient clinic at the Department of Surgery, University Hospital Tübingen, Tübingen, Germany. All patient and wound assessment data are recorded within a special wound documentation system\(^{25}\) by specially trained wound care nurses for a maximum of 365 days.

**Inclusion criteria.** To be included in the study, patients had to have an initial wound area of at least 0.1 cm\(^{2}\) and treated for a minimum of 2 weeks using standard moist wound therapy followed by a minimum of 4 weeks using the cellulose dressing. During both treatment periods, at least two wound center visits had to have been documented.

**Wound characteristics.** Wounds were classified according to wound etiology (ie, diabetic ulcer, venous ulcer, ischemic ulcer, or other etiologies) and ulcer depth (dermis = grade 1, subcutaneous = grade 2, fascia = grade 3, muscle = grade 4, and bone = grade 5). Soft tissue infection was diagnosed if a purulent discharge and at least two other local signs of infection (warmth, erythema, lymphangitis, lymphadenopathy, edema, pain) were present. Soft tissue infections were managed using oral or intravenous antibiotics in outpatient or inpatient settings; treatment depended on the severity of infection.

Ulcer area was measured by photoplanimetric measurements; where the area of circumferential ulcers was not measurable, a wound size of 500 cm\(^{2}\) was documented. The percentage of area reduction was defined as follows:

Area end of therapy minus area beginning of therapy x 100 divided by area before therapy, where area was given in cm\(^{2}\).

By this calculation, a completely healed ulcer had a percentage area reduction of 100%.

Ulcer pain was rated by the patients using a visual analogue scale (0 = no pain to 10 = maximum pain). Pain reduction within the observation period was defined as a reduction in this score.

**Treatment.** Wounds were treated according to a comprehensive wound care protocol as previously
In brief, wound care consisted of sharp debridement, followed by moist wound therapy. In addition, adequate pressure offloading was used for plantar ulcers, compression therapy (stockings, class II or four-layer short stretch bandages) for venous ulcers, and sharp debridement provided as needed. Treatment was performed by an interdisciplinary team comprised of a general and vascular surgeon, a radiologist, a diabetologist, an orthotist, and a specially trained wound care nurse. All wounds were cleansed with sterile saline solution. Standard care dressings include foams, hydrocolloids, and petroleum-impregnated gauzes. The cellulose dressing was covered with a secondary dressing (petroleum-impregnated gauze).

**Data.** Data retrieval and analysis were performed by the principal investigator. Values are presented as median (range). Differences between the groups were calculated using the Wilcoxon rank test, where \( P < 0.05 \) was defined as statistically significant. Baseline and final data were compared using a \( t \)-test.

**Results**

Of the 83 patients (155 wounds) treated with cellulose dressings, 54 (96 ulcers) were treated with both the standard and cellulose dressing and met the inclusion criteria. Twelve patients (22%) had diabetic ulcers, 21 (39%) had venous ulcers, 14 (26%) had ischemic ulcers, and seven (13%) had ulcers of other etiologies (pressure, vasculitis, laparotomy wounds).

Initial median wound area was 6.7 (0.1 to 500) cm²; six were circumferential ulcers. Initial grading revealed 69 (72%) subcutaneous ulcers, 10 (10%) with muscle or tendon involvement, and 17 (18%) with positive probing to bone. Twenty-seven ulcers (28%) presented with local soft tissue infection. Median time of wound duration before therapy in the authors’ wound care center was median 51 (7 to 5,851) days (see Table 1).

**Wound care outcomes.** The 96 ulcers were treated with standard care regimen for a median of 184.5 (14 to 365) days. The median wound area of these ulcers increased but did not change significantly (from 6.7 to 7.39 [0.02 to 500] cm², \( P = 0.22 \)) with standard care. The median percentage of area reduction during this treatment period was 0.0% (-99.82 to 5,597). The cellulose dressings were applied for a median of 172 (14 to 365) days. Median ulcer size decreased significantly from 7.39 (0.02 to 500) cm² to 2.9 (0 to 500) cm², \( P = 0.0001 \). Median percent wound area reduction was −38.6% (−100 to 92,492). The difference in mean percent reduction following use of the two dressing regimens was significantly different (−35% [-100 to 92,492] versus 0.0 [-99.82 to 5,597], \( P = 0.006 \)).

Subgroup analysis by ulcer etiology did not show any significant differences in treatment time or change in ulcer area between treatment regimens (see Table 2). The percentage reduction in wound area using standard care was +28.4% for venous ulcers, 0% for ischemic, and 0% for diabetic foot ulcers. Following the use of cellulose dressings, the average reduction in ulcer area was -40% for venous, -75% for ischemic, and 14.7% for diabetic ulcers.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Patient (N=54) and Wound Characteristics (N=96) at the First Visit</th>
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</thead>
<tbody>
<tr>
<td>Median age (range)</td>
<td>74 (38-91) years</td>
</tr>
<tr>
<td>Gender</td>
<td>Male: 20 (37%)</td>
</tr>
<tr>
<td></td>
<td>Female: 34 (63%)</td>
</tr>
<tr>
<td>Median wound duration (range)</td>
<td>51 (14-5,851) days</td>
</tr>
<tr>
<td>Initial median wound size (range)</td>
<td>6.7 (0.1-500) cm²</td>
</tr>
<tr>
<td>Circumferential ulcers</td>
<td>6 (6%)</td>
</tr>
<tr>
<td>Initial number of wounds with wound infection</td>
<td>27 (18%)</td>
</tr>
<tr>
<td>Location</td>
<td>Foot: 45 (47%)</td>
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<tr>
<td></td>
<td>Leg: 49 (51%)</td>
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<tr>
<td></td>
<td>Other: 2 (2%)</td>
</tr>
<tr>
<td></td>
<td>Subcutaneous: 69 (72%)</td>
</tr>
<tr>
<td></td>
<td>Muscle, fascia: 10 (10%)</td>
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<tr>
<td></td>
<td>Bone, joint, tendon: 17 (18%)</td>
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<table>
<thead>
<tr>
<th>Table 2</th>
<th>Median (Range) Treatment Times by Wound Type</th>
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<tbody>
<tr>
<td>Ulcer etiology</td>
<td>Standard care</td>
</tr>
<tr>
<td>Diabetic foot</td>
<td>152 [14-365]</td>
</tr>
<tr>
<td>Venous</td>
<td>254 [14-365]</td>
</tr>
<tr>
<td>Ischemic</td>
<td>204 [14-365]</td>
</tr>
<tr>
<td>Other</td>
<td>35 [14-91]</td>
</tr>
<tr>
<td>Total</td>
<td>184 [14-365]</td>
</tr>
</tbody>
</table>
adverse events related to the dressing occurred, including allergy or skin irritation. Pain reduction was evident after standard care in 33% of the patients; following use of the cellulose dressing, an additional 28% of the patients reported less pain.

Discussion

Because positive outcomes using a cellulose dressing were subjectively observed for more than 2 years, the authors conducted a retrospective analysis of data, facilitated by a wound documentation system through which all patients are followed-up for 1 year. Comparison between treatment outcomes was possible because 54 patients were treated initially with standard care and subsequently received local therapy with the cellulose dressing within comparable time periods.

The study population represents patients with hard-to-heal ulcers, demonstrated by the long wound duration and large ulcer size. This might be one reason for standard wound care therapy failure (ie, no progression to healing). Failure was evidenced by the slight increase of the median ulcer area after a treatment of more than 20 weeks, allowing the authors to define the ulcers in this patient population as hard-to-heal in concordance with other authors. In this population, it was not surprising that even after therapy with the cellulose dressing, only six patients (10%) completely healed within the treatment time of about 24 weeks. However, actual and percent ulcer area reduction improved after cellulose dressing treatment. Venous leg ulcers and ischemic ulcers responded especially well to management with the cellulose dressing; venous ulcers reduced an average of 40% in size after 29 weeks of care. Results from a control group of hard-to-heal venous ulcers in a prospective, controlled, multicenter study showed a >20% reduction in ulcer area after 20 weeks of care. In a prospective, randomized, controlled multicenter study by Steed et al., the observed percent reduction in diabetic foot ulcers after 8 weeks of standard care was shown to be approximately -50%. In the current study, a percentage of area reduction after the same period of time was 20%. Among different wound etiologies, the cellulose dressing seems to work the best in venous and ischemic ulcers.
No severe skin maceration, irritation, or allergies were observed in the current study. These problems are a common consideration when new dressings are presented on the market. The difference in pain reduction between standard care and cellulose dressings was not statistically significant. Approximately one third of the current study participants noted pain reduction after using the cellulose dressing. In a small, prospective, parallel-group comparative open trial involving 24 patients, Alvarez et al. demonstrated reduced pain with this type of dressing; the current study underscores the need for proper pain assessment and documentation, including type of pain medication and patient adherence to pain protocols.

**Limitations**

The results obtained must be interpreted with caution. In addition to the limitations inherent in retrospective studies, many patients had more than one wound which could have influenced the results. Furthermore, the reason for the therapy change to the cellulose dressing was an individual decision of the wound care team and not guided by a standardized protocol of care or established criteria. Therapy change was indicated based on reasonable side effects of the dressing in use or a failed healing response. These limitations prohibit generalization of results to other study populations.

**Conclusion**

A retrospective chart review of results achieved using a cellulose dressing showed significantly greater wound area reduction compared to previous treatment using standard care in a patient population with difficult-to-heal ulcers. No local skin problems or allergies related to using this new dressing were found. Cellulose dressings appear to be a viable option in chronic wound care, especially venous and ischemic ulcers. Prospective, controlled clinical studies are needed to ascertain the effectiveness of this dressing compared to current standards of care.

**References**

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